

What is claimed is:

1. A computer-implemented method for analyzing a structure comprising:

5 receiving linear elastic input data of a structure;

automatically determining non-linear input data based on the received linear elastic input data;

analyzing the determined non-linear input data through a non-linear analysis technique; and

10 outputting the result of analysis.

2. The method according to claim 1, further comprising determining a static load pushover profile for use in a static load pushover analysis.

3. The method according to claim 1 wherein the step of
15 automatically determining non-linear input data includes automatically determining the envelope behavior, degradation behavior, and failure behavior of members of the structure based on previously determined models of the members and the received linear elastic input data.

20 4. The method according to claim 3 wherein at least a part of the data for the previously determined models is based on experimental or empirical data, and each model is stored as a plurality of data points, a mathematical representation, or both.

25 5. The method according to claim 1 wherein the step of analyzing includes using a minimization technique to minimize the storage requirements of a global stiffness matrix and local stiffness matrix.

6. The method according to claim 1 wherein the step of analyzing includes using a numerical solution technique that requires only one copy of a global stiffness matrix.

5 7. The method according to claim 1 wherein the step of analyzing includes reformulating and reducing only a portion of a global stiffness matrix that changes due to change in member state or large displacement effects.

8. The method according to claim 1 wherein the step of
10 analyzing includes using a sufficiently higher order integration method to increase the step size thereby reducing the number of steps required for analysis.

9. The method according to claim 1 wherein the step of analyzing includes:

15 using a minimization technique to minimize the storage requirements of a global stiffness matrix and local stiffness matrix;

using a numerical solution technique that requires only one copy of the global stiffness matrix;

20 reformulating and reducing only a portion of a global stiffness matrix that changes due to change in member state; and

using a sufficiently higher order integration method to increase the step size thereby reducing the
25 number of steps required for analysis.

10. The method according to claim 1, further comprising displaying a summary of inelastic sequence of events for damaged members of the structure.

11. The method according to claim 10 wherein the summary includes global, regional, and local damage measures.

12. The method according to claim 11 wherein:

5 the global damage measure includes global displacement ductility and number of damaged members;

 the regional damage measure includes one or more of inter-story drifts, inter-story shears, number of damaged members in the region, and identification of
10 damaged members; and

 the local damage measure includes maximum member ductilities, cumulative member ductilities and number of cycle reversals.

13. The method according to claim 1 wherein the step of
15 outputting includes outputting a color-coded image of the structure showing different levels of damage to the members of the structure.

14. The method according to claim 1, further comprising:

20 repeating the analyzing step for each of a plurality of intensities or probabilities of a preselected catastrophic load; and

 displaying the number of damage measures as a function of the intensities or probabilities of the
25 preselected catastrophic load.

15. The method according to claim 14, further comprising using the damage measures to assess monetary losses or to make a financial or mitigation decision.

16. A computer-implemented method for analyzing a structure comprising:

classifying a plurality of structures according to predetermined structure types;

5 sub-classifying the structures within each classified structure type by fundamental structure periods;

determining damage functions for the sub-classified structures; and

10 storing the determined damage functions.

17. The method according to claim 16, further comprising determining non-structural damage functions corresponding to the structural damage functions.

18. The method according to claim 16 wherein the step
15 of classifying includes classifying the plurality of structures according to either FEMA guidelines or building code guidelines.

19. The method according to claim 16 wherein the step of sub-classifying includes sub-classifying as similar
20 structures all structures within a classified structure type whose fundamental structure period falls within a predetermined range.

20. The method according to claim 16, further comprising:

25 receiving location and other data of a first structure;

identifying among the plurality of classified structures one classified structure that corresponds to the first structure; and

retrieving the stored damage function of a sub-classified structure that corresponds to the identified structure for analysis of the first structure.

21. The method according to claim 16, further
5 comprising:

determining a fault that likely causes damage to the first structure;

determining at least one spectral acceleration of the determined fault line to the structure; and

- 10 determining a damage measure for the determined spectral acceleration from the retrieved damage function.

22. The method according to claim 16 wherein the step of determining damage functions includes:

- 15 determining damage functions of a plurality of previous disasters; and

calculating a mean damage function from the determined damage functions by regression.